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PROGRESS REPORT
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FOR
SKYLAB STUDY OF WATER QUALITY
NASA CONTRACT NAS 9-13271

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SUMMARY OF RESEARCH OBJECTIVES

Two Kansas reservoirs will be studied using Skylab data in conjunction with simultaneous ground truth information in an attempt to detect and monitor various parameters of water quality. Water samples will be collected from the reservoir or reservoirs under investigation and low-level aircraft support missions will be flown to acquire photographs which will approximate the spectral coverage of forthcoming Skylab photographs. Image analysis and data processing techniques will be developed to aid in the correlation of Skylab data with ground truth data and supporting aerial photography.

A. OVERALL STATUS

EREP data products thus far received for the Sept. 18, 1973 over southeast Kansas include S-190A positive transparencies. These photos cover three lakes, Toronto, Fall River, and Elk City reservoirs. Concurrent with satellite overflight, field crews were on all three lakes collecting water samples. These samples were analyzed for concentrations of bicarbonate, carbonate, calcium, magnesium, potassium, sodium, sulfate and chloride. In addition, total solids, total heat-stable solids, suspended solids, heat-stable suspended solids, and pH were determined.

The four black and white S-190A products were analyzed quantitatively with a Macbeth QUANTALOG macrodensitometer. The bands analyzed were 0.5-0.6 μ -green (roll 48), 0.6-0.7 μ -red (roll 47), 0.7-0.8 μ -first infrared (roll 43), and 0.9-1.0 μ -second infrared (roll 44). Measurements were made on 70mm. transparencies using a 70mm. aperture. Receipt of step-tablets from the Photographic Technology Division of the Johnson Space Center allowed cross-calibration of our densitometer with theirs. Due to the small size of the reservoirs being investigated on 70mm. film, only one density measurement was made for each lake photo. However, based on sample analysis, the lakes were well mixed at the time of sampling and thus water quality parameters have a narrow range of values within a given lake. In addition, the value ranges of the major water quality parameters such as suspended solids and dissolved solids within individual lakes are mutually exclusive. Spot density measurements of the lakes taken from 4X enlarged transparencies reveal little density variation within

each lake. Thus a lack of multiple density readings over the lakes is not a serious loss of data or control.

Figure 1 is a plot of density versus suspended solids for all three lakes on all four bands of black and white S-190A photography. Points for each lake represent the average value of suspended solids for the samples collected; brackets indicate the range of values for each lake. The plots for all four bands of photography decrease with increasing concentrations of suspended solids. The response of photographic density to suspended solids on the 70mm. photography is better than that determined previously from the 4X enlarged transparencies. The enlargements appear to be made with little photometric control. As a result, the infra-red bands show little response to increasing suspended solids, and on the green and red bands one of the lakes, Elk City, has anomalously low densities that disrupt the density-suspended solids correlation.

The densities in Figure 1 were converted to radiometric units following the procedures and using the data on the SL/3 Sensitometric Data Package (report number JL12-503). These radiometric units were then plotted versus suspended solids (Figure 2). These curves are similar to those produced using ERTS digital tape values recorded over Perry and Tuttle Creek reservoirs to the north. The red green bands show the best response to increases in suspended solids, at least for the low concentrations being considered. The Skylab curves are also similar in shape to the ERTS curves in that they are convex upward and their slopes are steepest for the low concentrations and curves tend to flatten out as concentrations increase.

Band ratios (Figure 3) do not appreciably improve correlations between 70 mm.-derived data and suspended solids as they did in the case of data taken from the 4X enlarged transparencies. In the latter case, ratioing appears to have overcome the lack of photometric control in the reproduction of the enlargements.

B. RECOMMENDATIONS CONCERNING DECISIONS AND/OR ACTIONS
REQUIRED TO ENSURE ATTAINMENT OF THE EXPERIMENTS SCIENTIFIC
OBJECTIVES.

NONE.

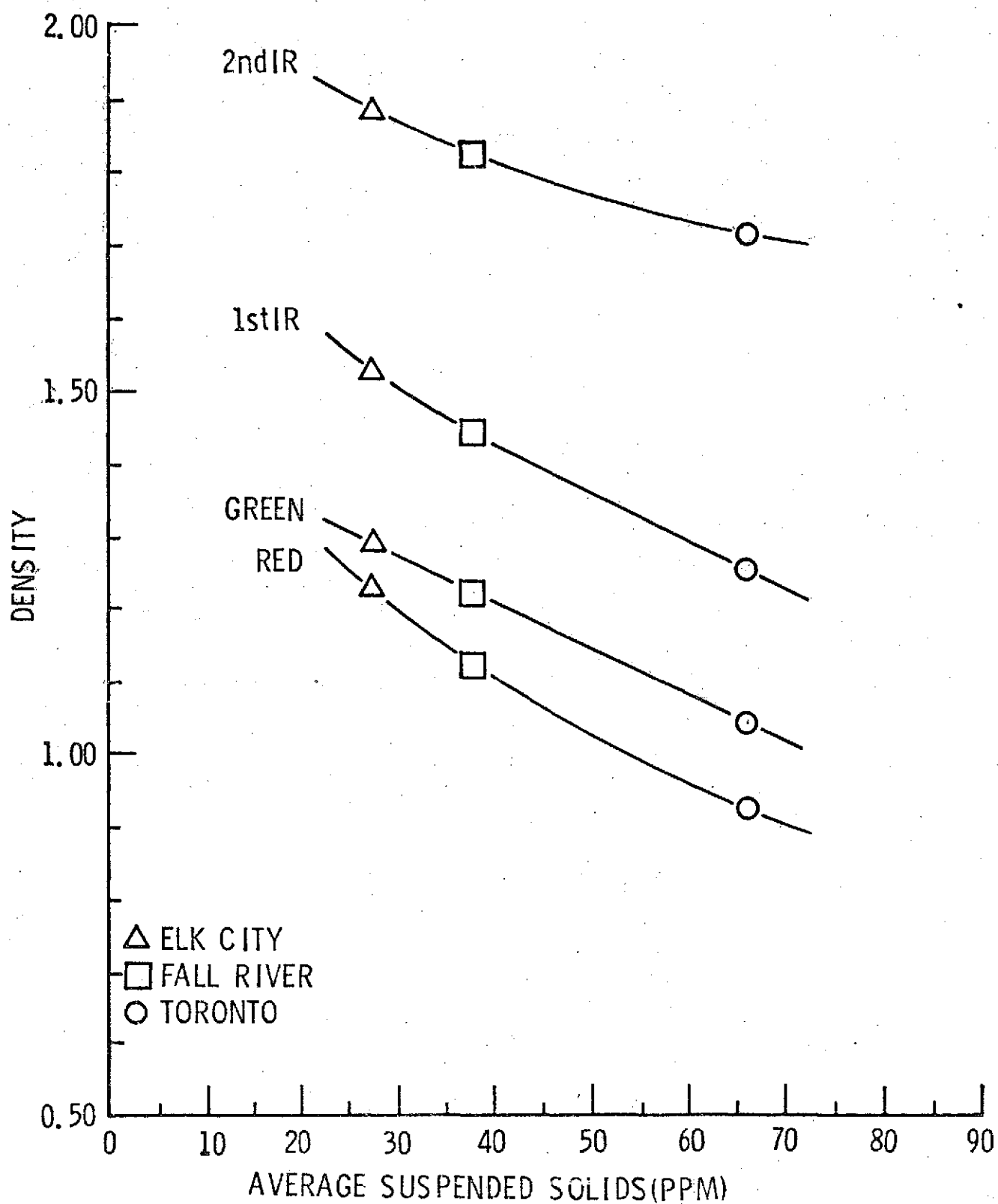


FIGURE 1. S-190A DENSITY VS. AVERAGE SUSPENDED SOLIDS FOR 3 SOUTHEAST KANSAS RESERVOIRS, SEPT. 18, 1973.

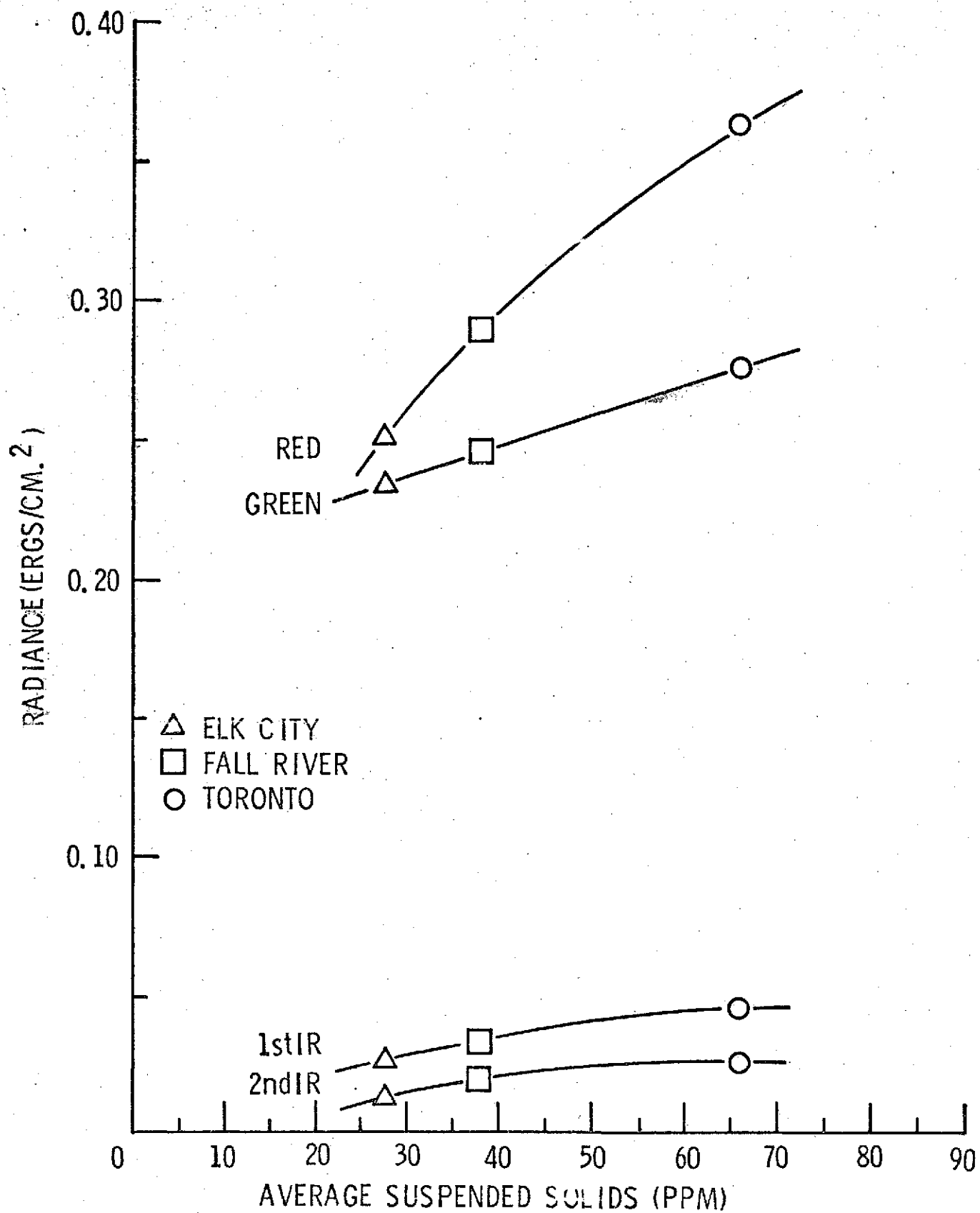


FIGURE 2. S-190A RADIANCE VS. AVERAGE SUSPENDED SOLIDS FOR 3 SOUTHEAST KANSAS RESERVOIRS, SEPT. 18, 1973.

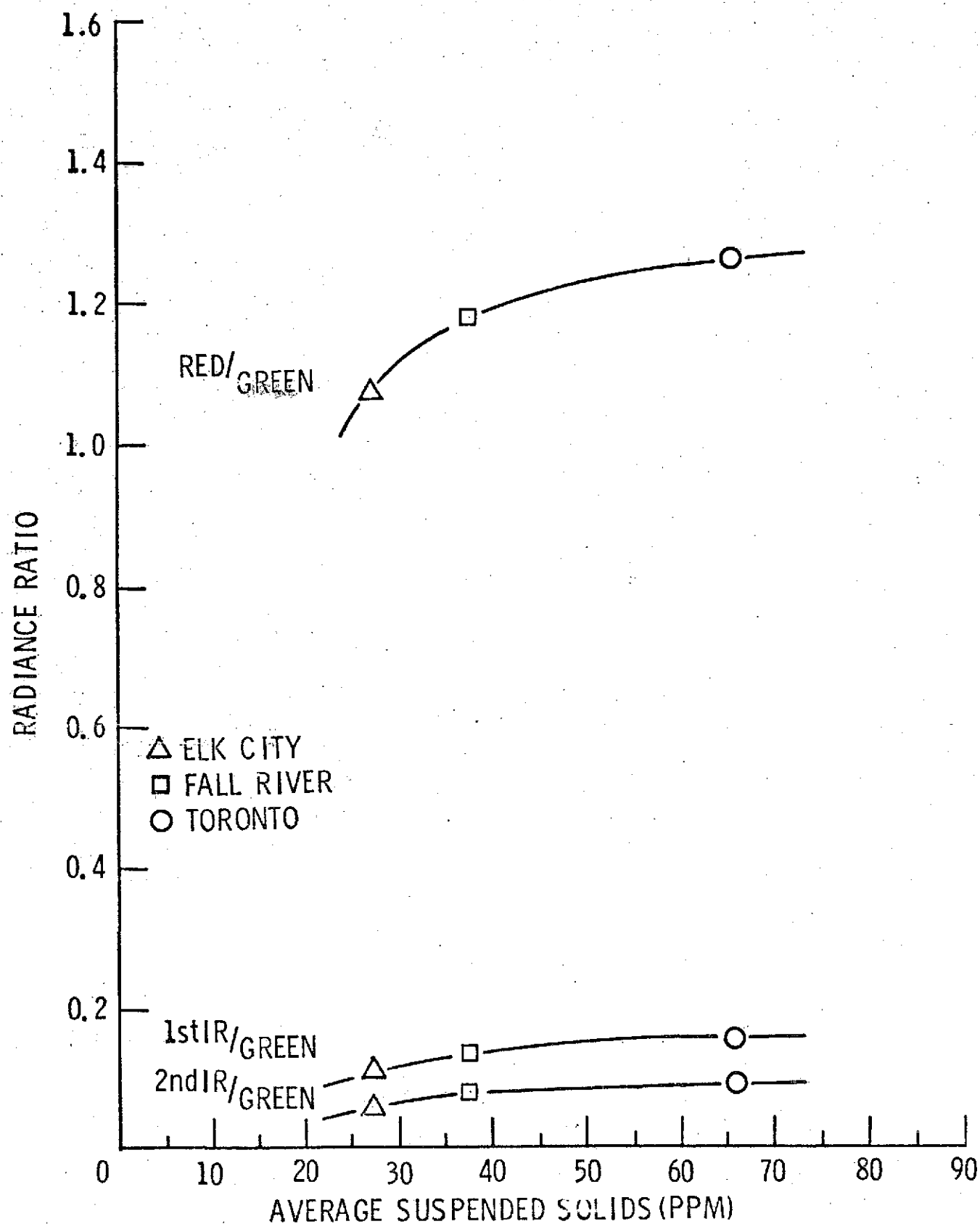


FIGURE 3. S-190A RADIANCE RATIOS VS. SUSPENDED SOLIDS FOR 3 SOUTHEAST KANSAS RESERVOIRS, SEPT. 18, 1973.

C. EXPECTED ACCOMPLISHMENTS DURING THE NEXT REPORTING PERIOD.

From recent correspondence with NASA-JSC it appears that S-192 tapes recorded simultaneously with the S-190 photography discussed in this report are forthcoming. Processing and analysis of this data will begin upon its arrival.

D. SIGNIFICANT RESULTS AND THEIR RELATIONSHIP TO PRACTICAL APPLICATIONS OR OPERATIONAL PROBLEMS.

Radiometric data derived from S-190A photography appears to correlate reasonably well with suspended solids without the need of ratioing the radiances of different bands.

E. SUMMARY OUTLOOK FOR THE REMAINING EFFORT TO BE PERFORMED

Analysis of S-192 digital data should begin immediately upon its arrival. Our data processing team has gained expertise in processing this data from work performed for other Skylab projects at our facility. Thus, retrieval of data necessary for our purposes should not be a problem and comparison with ground truth and S-190 analysis can proceed from there.

F. TRAVEL SUMMARY AND PLANS

NONE.

FINANCIAL REPORT

A statement of financial status for this project will be sent under separate cover by the CRINC account office.